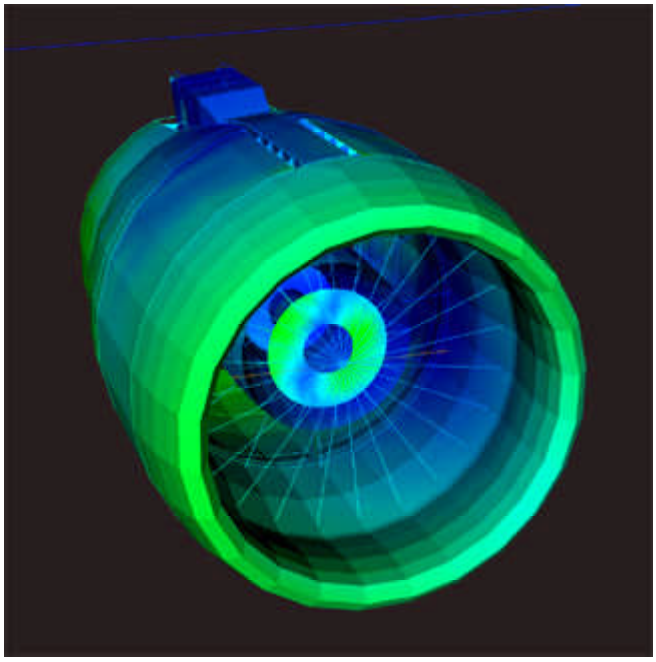
Virtual Reality Used to Serve the Glenn Engineering Community

There are a variety of innovative new visualization tools available to scientists and engineers for the display and analysis of their models. At the NASA Glenn Research Center, we have an ImmersaDesk, a large, single-panel, semi-immersive display device. This versatile unit can interactively display three-dimensional images in visual stereo. Our challenge is to make this virtual reality platform accessible and useful to researchers. An example of a successful application of this computer technology is the display of blade out simulations.

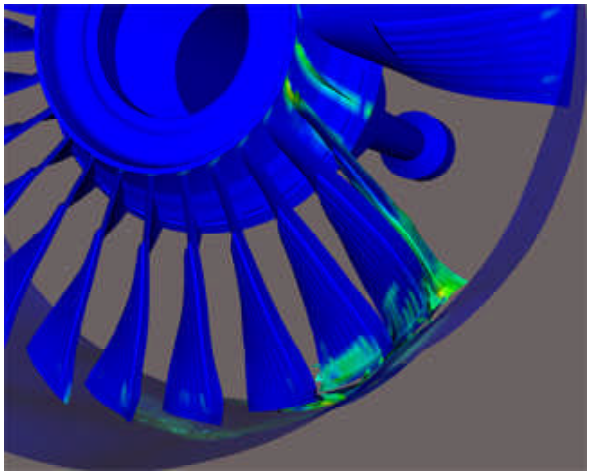
NASA Glenn structural dynamicists, Dr. Kelly Carney and Dr. Charles Lawrence, funded by the Ultra Safe Propulsion Project under Base R&T, are researching blade outs, when turbine engines lose a fan blade during operation. Key objectives of this research include minimizing danger to the aircraft via effective blade containment, predicting destructive loads due to the imbalance following a blade loss, and identifying safe, cost-effective designs and materials for future engines.



Glenn engineers, in collaboration with industry partners, model jet engines to predict loads due to blade loss. When displayed in a time sequence on the ImmersaDesk, subtle effects become apparent.

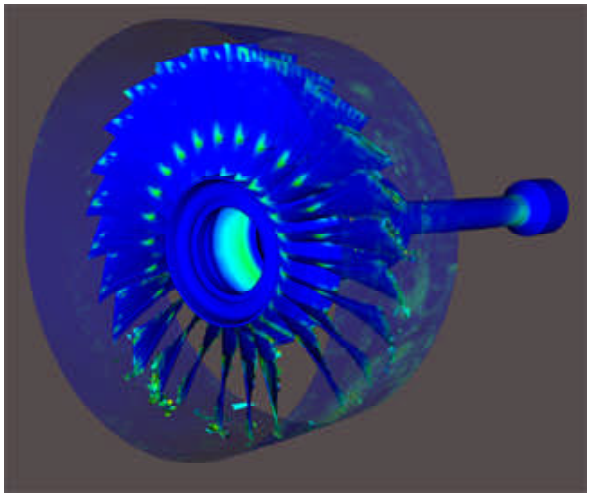
A blade out event is dramatic, complex, and fast moving. It is an excellent application for the ImmersaDesk platform. The event is modeled over time in a computer simulation. Physics-based modeling is used to predict the complex interactions between the fan rotor, the remaining fan blades, and the engine casing during a blade loss. Colors show a selected variable, such as plastic strain. The time steps of the simulation are displayed in sequence.

To view the model on the ImmersaDesk, researchers wear stereoscopic gog-gles with liquid-crystal lenses. As a result, the model has depth and it is easier to interpret the physical events and mechanical interactions. Using a hand-held wand, a researcher can rotate, translate, and zoom the model interactively in real time. The researcher has now entered into semi-immersive virtual reality. Other observers, also wearing goggles, can watch as the three-dimensional model is manipulated. The display can be interactive or, if desired, a sequence can be captured and replayed as an animation.



Researchers can use an interactive wand to zoom in for closeups of their models. This fan interaction simulation shows the dramatic results of a blade loss.

As a part of the blade out research, Glenn engineers are working with engineers from Boeing Commercial Aircraft, GE Aircraft Engines, and Pratt & Whitney to develop new computer simulation tools for analyzing engine airframe structural systems. Glenn's physics-based computer simulations were successfully demonstrated on the ImmersaDesk for a large group of visiting representatives from those industry partners. In addition to being useful onsite for such collaborations, the ImmersaDesk is portable and can be shipped offsite for use at conferences and expositions so that NASA visualizations can be presented to a wider audience.



This fan interaction model can be viewed in stereo from all angles on the ImmersaDesk

while cycling through the time steps of the traumatic blade out event.

Find out more about this research:
Ultra Safe Propulsion Project
(http://www.grc.nasa.gov/WWW/AERO/base/UltraSafe.htm)

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